Device/User Interface Software Requirements For Tracking Data Formatter (TDF)

Version 1.0

April 2, 1997

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Final and Signed 04/09/97

Table of Contents

1.0 Introduction

This document provides device and user interface requirements for the integration of the Tracking Data Formatter (TDF) into the family of devices controllable by a Master Computer (MC) at NASA ground stations in Svalbard, Norway and Alaska (SGS/AGS). The TDF is responsible for processing antenna angle inputs, as well as Doppler ranging, and timing information, in order to produce positional data products for use by other range of worldwide tracking assets. Time series data are output in the Universal Tracking Data Format (UTDF) via an RS-422 port and the Minimum Delay Data Format (MDDF) over an RS-232 line.

2.0 Required Functionality

The system will adhere to the Master-Node design governing the automation of all devices. A *Tracking and Command* (T&C) node computer will be connected between the MC and TDF in order to relay serial status and setup messages. Setup, status monitoring and takedown of the TDF will be accomplished via an RS-232 port. The (T&C)node computer will collect, archive the real-time data records in Universal Tracking Data Format(UTDF), and process real-time data records received from the TDF. Upon completion of the support the UTDF data file is transferred to the Master Computer. The disposition the UTDF data file, on the Master, is TBD.

3.0 Parameter Ranges

The parameter ranges are defined in the TDF Operator's manual

4.0 Communications Protocol

The T&C will communicate with the TDF directly using an RS-232 port at 9600, no parity, eight data bits, one stop bit. The interconnection between the TDF and T&C will be a null modem cable.

5.0 GUI Functionality

A Windows-based graphical user interface using pull-down menus, buttons or input fields will be developed and displayed on the T&C to allow the operator remote control over certain functions on the TDF. Control commands include Record mode, MDDF, TDF and Doppler status, as well as high and low speed UTDF and record mode. Setup commands remotely controlled by the MC when the TDF is in run mode include setting the support ID code (0-8191), the vehicle ID (0-15), uplink frequency and Doppler mode.

See Appendix A: Graphical User Interface Requirements

6.0 Command Scripting

See Appendix B: Scripting Requirements

7.0 High-level Status

The high level status consists of Doppler range, azimuth, and elevation parameters from the data records received from the TDF. The received data records will be displayed in the high-level status window on the Master Computer. The TDF status during idle state will be monitored periodically by

sending a simple, recognizable command and checking the return serial packet for a carriage return character.

This device differs from the normal devices in that polling of the device for status is not required. The TDF is a unique type of device, which transmits data records at a rate of 10 PPS. These records are archived on the T&C node computer, which in turn extracts range, azimuth and elevation parameters from the data records and sends them to the Master. These data records are only received if a support has been started. The state of the TDF can be determined by the reception of these records.

See Appendix C: TDF RS232 Serial Data Format

8.0 Replacement Algorithm

No data quality checks on incoming data will be performed. The T&C node, however, will perform simple output file size checks during operation in order to verify a non-failed state. High-level status can also be reviewed for a simple "TDF error " message.

Appendix A: Graphical User Interface Requirements

The user will be able to access the following remote controllable features.

Control Commands

1) Start or Stop the TDF
2) Enable or disable Doppler status override
3) Enable or disable MDDF Mode
4) Set High Speed UTDF Mode
   a) Off
   b) 1 sample/second
   c) 10 samples/second
5) Enable or disable Low Speed Mode
6) Enable or disable Record Mode

Setup Commands

1) Set Support Id Code (0 – 8191)
2) Set Vehicle Id (0 to 15)
3) Set Up link Frequency (2000.0000 to 2120.0000 MHz)
4) Set Doppler Mode (1,2,3)

Data Parameters

1) Time
2) Azimuth
3) Elevation
4) Doppler Range
5) Doppler Mode
6) Antenna Status

Appendix B: Scripting Requirements

Master	Node	Comments/Error Handling

Resource Request Specific
Parameter: unit number
 	
TDF Specific Parameters
 	
Frequency
Doppler Mode
High speed UTDF Mode
Low speed UTDF Mode
MDDF Mode
Record Mode
Support Identifier Code
Vehicle Id
	Start
	
	Check allocation table for unit number
	
	If available then
	Mark unit as assigned to this Master
	Reply “Unit # assigned”
	Open log file
	Retrieve configuration file from this Master
	Open Data File for UTDF Data
	Else
	Reply “Unit # not available”
	End
	
	Stop	

Resource Request General
Parameter: unit number = -1
 	
TDF Specific Parameters
 	
Frequency
Doppler Mode
High speed UTDF Mode
Low speed UTDF Mode
MDDF Mode
Record Mode
Support Identifier Code
Vehicle Id
	Start
	
	Check allocation table for an available unit using the least recently used method
	
	If available then
	Mark unit as assigned to this Master
	Reply “Unit # assigned”
	Open log file
	Retrieve configuration file from this Master
	Open Data File for UTDF Data
	Else
	Reply “No units available”
	End
	
	Stop	

Setup Parameter: unit number	Start	

Master	Node	Comments/Error Handling

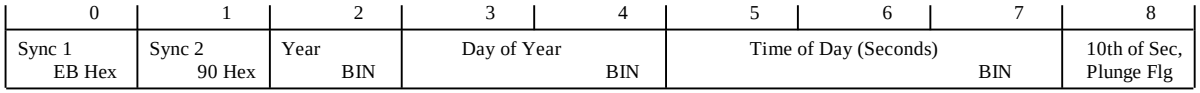
Frequency
Doppler Mode
High speed UTDF Mode
Low speed UTDF Mode
MDDF Mode
Record Mode
Support Identifier Code
Vehicle Id
	Verify possession of unit by this Master
	
	If not assigned to this Master then
	Inform this Master
	Stop
	End
	
	Load and Verify configuration file
	
	Set Frequency
	Set Doppler Mode
	Set High Speed UTDF Mode
	Set Low Speed UTDF Mode
	Set MDDF Mode
	Set Record Mode
	Set Support Identifier Code
	
	If configuration file error then
	Inform this Master
	Stop
	End
	
	Stop
		>> Operator intervention required
		
		>> Operator intervention required

Start Support Parameter: unit number	Start Verify possession of unit by this Master If not assigned to this Master then Inform this Master Stop End Start TDF Send Doppler Valid to TDF Begin Logging UTDF Data Records Stop	>> Operator intervention required
Stop Support Parameter: unit number	Start Verify possession of unit by this Master	

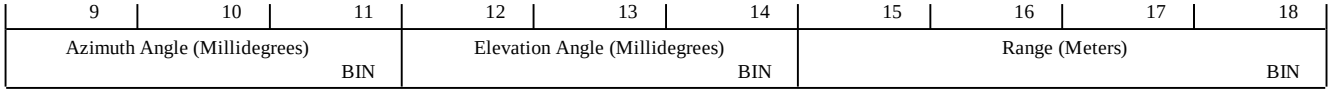
Master	Node	Comments/Error Handling
	If not assigned to this Master then Inform this Master Stop End Stop TDF Stop Logging UTDF Data Records Stop	>> Operator intervention required
Takedown Parameter: unit number	Start Verify possession of unit by this Master If not assigned to this Master then Inform this Master Stop End Close UTDF Data Record File Send UTDF Data Record File to Master Mark unit as not assigned Close log file Send log file to this Master Stop	>> Operator intervention required * Possibly log this data in log file instead of separate file.

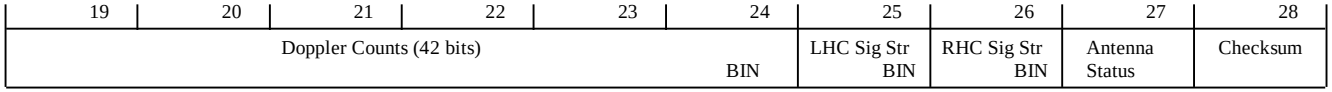
Appendix C: TDF RS232 Serial Data Format

TDF RS232 Serial Data Format



Plunge Flg: Bit 4 (1 = plunge)
10th of Sec: Bits 0-3





Byte 24:
Doppler MSB's: Bits 0-1
Doppler Valid: Bit 4 (0 = good)
Range MFR: Bit 5 (0 = LHC)

Az Auto: Bit 0
El Auto: Bit 1
Az Man: Bit 2
El Auto: Bit 3
Az Rmt: Bit 4
El Rmt: Bit 5
Polarity: Bit 6
Data Vld: Bit 7

Notes:
1. For each parameter, the least significant byte is transmitted first.
2. For each byte, the LSB is Bit 0, MSB is Bit 7.
3. Checksum, Byte 28, is the modulo 256 sum of bytes 2-27.

4/2/97